

## **ATTACHMENT 7**

### **Concrete Mix Design**

CARSON RIVER BRIDGE  
ERFO BIA WASH 1(1)

# PORTLAND CEMENT CONCRETE MIX DESIGN<sup>1</sup> TRIAL BATCH SUMMARY

Project: WVERFO-BHM-WASH(11) Canyon River Bridge Date: 5/2/00  
Contractor: Kie. Con Concrete for: Type III Graders  
Concrete producer: TPAC Class of concrete: P  
Mix designation: 2248M

## • COMPRESSIVE STRENGTH (28 DAY)

Minimum average strength required<sup>2</sup> ( $f_{cr}$ ) 49.55 megapascals (MPa)

Design strength specified ( $f'_c$ ) 45 MPa

## • PROPORTIONS

Material	Specific Gravity (SSD)	SSD Mass per m <sup>3</sup> (kg)	Absolute Volume (m <sup>3</sup> )	Tolerance % ( $\pm$ )	Admixtures	Dosage per m <sup>3</sup> (mL)
Cement	3.15	<u>446</u>	<u>0.142</u>	1	Air entrainment	
Water	1.00	<u>156</u>	<u>0.156</u>	1	Water reducer	<u>1160</u>
Coarse aggregate <sup>3</sup>	<u>2.59</u>	<u>1060</u>	<u>0.409</u>	2	Retarder	
Fine aggregate <sup>3</sup>	<u>2.59</u>	<u>707</u>	<u>0.273</u>	2	Color	
Total air			<u>0.02</u>		Accelerator	
Other					Other <u>Plasticizer</u>	<u>4370</u>
Totals		<u>2369 kg</u>	<u>1.000 m<sup>3</sup></u>			

## • PROPERTIES

Water/cement ratio (by mass)<sup>4</sup> 0.35  
Measured unit mass 2369 kg/m<sup>3</sup>

Theoretical unit mass  
Measured air content  
Measured slump

none kg/m<sup>3</sup>  
Provided percent  
mm

## • MEASURED COMPRESSIVE STRENGTH

Individual 7-day, MPa \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_ Average (7 day): \_\_\_\_\_ MPa  
Individual 28-day, MPa \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_ Average (28 day): 52.76 MPa

<sup>1</sup> For normal mass portland cement concrete (2300 - 2500 kg/m<sup>3</sup>).

<sup>2</sup> See page 5.

<sup>3</sup> Bulk SSD.

<sup>4</sup> The water/cement ratio for modified concrete is the ratio of the mass of water to the combined masses of portland cement and cement substitute.

• SIGNATURES Contractor: \_\_\_\_\_  
Mix Designer: \_\_\_\_\_

**PORTLAND CEMENT CONCRETE MIX DESIGN<sup>1</sup> (Continued)**  
**MATERIALS SOURCE SUMMARY**

• **CEMENT (AASHTO M 85)**

Name and address of cement producer: Arizona Portland Cement Company

Source of manufacture: Rillito Cement Plant, Rillito Arizona

Type of cement: I/II Low Alkali

Materials certification attached: ☒ Yes ☐ No

• **WATER (725.01 and AASHTO T 26)**

Water potable: ☐ Yes ☐ No

If no, provide the following:

Water pH number \_\_\_\_\_  
 Chloride concentration \_\_\_\_\_ (ppm)  
 Sulphate ion concentration \_\_\_\_\_ (ppm)  
 Total solids content \_\_\_\_\_ (%)

• **ADMIXTURES**

Material	Producer and Product Designation	Certification Attached	
		Yes	No
Air entraining admixture	_____	<input type="checkbox"/>	<input type="checkbox"/>
Water reducing admixture, type A	<u>Peggo/lt 80</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Retarding admixture, type B	_____	<input type="checkbox"/>	<input type="checkbox"/>
Accelerating admixture, type C	_____	<input type="checkbox"/>	<input type="checkbox"/>
Water reducing and retarding admixture, type D	_____	<input type="checkbox"/>	<input type="checkbox"/>
Water reducing and accelerating admixture, type E	_____	<input type="checkbox"/>	<input type="checkbox"/>
Water reducing, high range admixture, type F	<u>Rheobuild 1000</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Fly ash, type _____	_____	<input type="checkbox"/>	<input type="checkbox"/>
Ground iron blast-furnace slag	_____	<input type="checkbox"/>	<input type="checkbox"/>
Silica fume (microsilica)	_____	<input type="checkbox"/>	<input type="checkbox"/>
Color additive	_____	<input type="checkbox"/>	<input type="checkbox"/>
Other: _____	_____	<input type="checkbox"/>	<input type="checkbox"/>

<sup>1</sup> For normal mass portland cement concrete (2300 - 2500 kg/m<sup>3</sup>).

# PORTLAND CEMENT CONCRETE MIX DESIGN<sup>1</sup> (Continued)

## MATERIALS SOURCE SUMMARY

### • COARSE AGGREGATE (703.02 AND AASHTO M 80)

Name of supplier/producer: San Xavier Rock & Materials

Location of material source: Cortaro Az

Material type: ☐ Gravel ☐ Crushed gravel ☐ Crushed stone ☐ Crushed blast furnace slag

Grading no.: 67

Government Test Results

#### Sieve Analysis:

Sieve Designation	Percent Passing	Specification
50 mm	_____	_____
37.5 mm	_____	_____
25.0 mm	_____	<u>100</u>
19.0 mm	<u>100</u>	<u>90-100</u>
12.5 mm	<u>75</u>	<u>-</u>
9.5 mm	<u>33</u>	<u>20-55</u>
4.75 mm	<u>5</u>	<u>0-10</u>
2.36 mm	<u>3</u>	<u>0-5</u>
1.18 mm	<u>0.6</u>	_____

#### Properties:

- (1) Coal and lignite \_\_\_\_\_ (%) (0-0.5)<sup>1</sup>
- (2) Deleterious chert \_\_\_\_\_ (%) (0-3)<sup>2</sup>
- (3) Sodium sulfate soundness<sup>2</sup> 8 (%) (0-12)<sup>3</sup>
- (4) Clay lumps and friable particles \_\_\_\_\_ (%) (0-2)<sup>3</sup>
- (5) LA abrasion \_\_\_\_\_, grading B, 28 % loss (0-40)<sup>3</sup>
- (6) Bulk specific gravity 2.52
- (7) Absorption 2.0 (%)
- (8) Bulk SSD specific gravity 2.57
- (9) Dry rodded unit mass 95 (kg/m<sup>3</sup>)
- (10) Minus 75  $\mu$ m 0.6 (%) (0-1)<sup>3</sup>
- (11) Adherent fines \_\_\_\_\_ (%) (0-1)<sup>3</sup>
- (12) Other \_\_\_\_\_

### • FINE AGGREGATE (703.01 AND AASHTO M 6)

Name of supplier/producer: San Xavier Rock & Materials

Location of material source: Cortaro Az

☐ Manufactured sand ☐ Natural sand ☐ Blend

#### Sieve Analysis:

Sieve Designation	Percent Passing	Accumulative Percent Retained
9.5 mm	<u>100</u>	_____
4.75 mm	<u>100</u>	_____
2.36 mm	<u>86</u>	<u>14</u>
1.18 mm	<u>61</u>	<u>39</u>
600 $\mu$ m	<u>37</u>	<u>63</u>
300 $\mu$ m	<u>17</u>	<u>83</u>
150 $\mu$ m	<u>5</u>	<u>95</u>

Fineness modulus: 2.94

#### Properties:

- | <u>Contractor Results</u>  | <u>Government</u> |
|--|-------------------|
| (1) Clay lumps <u>0</u> (%) (0-3) <sup>3</sup>                             |                   |
| (2) Coal and lignite _____ (%) (0-1) <sup>3</sup>                          |                   |
| (3) Sodium sulfate soundness <sup>2</sup> <u>6</u> (%) (0-10) <sup>3</sup> | <u>2</u>          |
| (4) Sand equivalent value, alt. 2 <u>89</u> (>75) <sup>3</sup>             | <u>84</u>         |
| (5) Bulk specific gravity <u>2.576</u>                                     | <u>2.53</u>       |
| (6) Bulk SSD specific gravity <u>2.617</u>                                 | <u>2.57</u>       |
| (7) Absorption <u>1.62</u> (%)   | <u>1.7</u>        |
| (8) Organic impurities <u>Clear</u>  | <u>Clear</u>      |
| (9) Minus 75 $\mu$ m <u>0.6</u> (%) (0-3) <sup>3</sup>                     | <u>Fm: 2.84</u>   |
| (10) Other _____   |                   |

<sup>1</sup> For normal mass portland cement concrete (2300 - 2500 kg/m<sup>3</sup>).

<sup>2</sup> At five cycles.

<sup>3</sup> Specification limits.

**PORTLAND CEMENT CONCRETE MIX DESIGN (Continued)  
DATA FOR COMPUTING THE COEFFICIENT OF VARIATION OF BATCHES**

Batch No.	Date Batched	7-Day Compressive Strengths (MPa)				28-Day Compressive Strengths (MPa)			
		Cyl. 1	Cyl. 2	Cyl. 3	Average ( $\bar{x}$ )	Cyl. 1	Cyl. 2	Cyl. 3	Average ( $\bar{x}$ )
1	03/31					7800	7720		7760
2						7960	7880		7920
3						8670	8750		8710
4						8670	8670		8670
5						8040	7880		7960
6						8040	7960		8000
7						7800	8350		8075
8						8040	8350		8195
9						7720	7680		7700
10						8040	7960		8000
11						8510	8550		8530
12						7800	7720		7760
13						7800	7880		7840
14						7560	7640		7600
15						8270	8190		8230
16						7560	7720		7640
17						8270	8040		8155
18						7200	7400		7300
19						7360	7120		7240
20						7760	7880		7820
21						7480	7160		7320
22						7000	7320		7160
23						7080	7160		7120
24						7000	7400		7200
25						6920	7000		6960
26						7080	7120		7100
27						6680	6840		6760
28						6840	6760		6800
29						6960	7040		7000
30						7080	7000		7040
31									

\* For normal mass portland cement concrete (2300 - 2500 kg/m<sup>3</sup>).

$$\bar{X} = \frac{\sum X}{N} = \frac{229565}{N} = 7652 \text{ (MPa)}$$

$$s = \sqrt{\frac{N \sum (X^2) - (\sum X)^2}{N(N-1)}} = 549$$

Where:

- $X$  = The 28-day batch average of at least 2 cylinders (3 preferred).
- $\bar{X}$  = The mean of the averages of 28-day compressive results.
- $s$  = The sample standard deviation of the 28-day batch averages.
- $N$  = The number of batches sampled.

**PORTLAND CEMENT CONCRETE MIX DESIGN (Continued)**  
**DETERMINATION OF MINIMUM MIX DESIGN COMPRESSIVE STRENGTH**

---

• **MINIMUM MIX DESIGN COMPRESSIVE STRENGTH ( $f'_m$ )**

Computed values from page 4:

$$\bar{X} = \underline{7652 \text{ psi}} = \underline{\hspace{2cm}} \text{ (MPa)} \quad s = \underline{549}$$

Where:

$s$  = The sample standard deviation of the 28-day compressive strength test results from page 4.

$\bar{X}$  = The mean of the 28-day compressive strength test results from page 4.

$V$  = The coefficient of variation<sup>1</sup> expressed as a decimal and calculated as follows:

$$V = \frac{s}{\bar{X}} = \frac{549}{7652} = \underline{0.0717} \text{ or } 0.15$$

$$f'_m = \frac{f'_c}{1 - kV} = \frac{6525 \text{ psi or } 45 \text{ MPa}}{1 - 1.28(0.0717)} = \underline{7185 \text{ psi or } 49.55 \text{ MPa}} \text{ (Mpa)}$$

Where:

$f'_c$  = The 28-day design compressive strength specified in the contract.

$k$  = A constant (1.28) for a probability that not more than 1 in 10 tests will fall below the specified compressive strength ( $f'_c$ ).

---

<sup>1</sup> For normal mass portland cement concrete (2300 - 2500 kg/m<sup>3</sup>).

<sup>2</sup> Use 0.15 for the coefficient of variation when there is insufficient test data available.

**PORTLAND CEMENT CONCRETE MIX DESIGN<sup>1</sup> (Continued)**  
**LABORATORY TRIAL BATCH MIX DESIGN SUMMARY**

Description	Equivalent Batch Masses (SSD mass/m <sup>3</sup> )				
	Batch 1	Batch 2	Batch 3	Batch 4	Batch 5
<b>Materials:</b>					
Cement (kg)					
Water (kg)					
Coarse aggregate (kg)					
Fine aggregate (kg)					
Air entrainer (mL)					
Water reducer (mL)					
High range water reducer (mL)					
Other _____					
<b>Properties:</b>					
Water/cement ratio					
Theoretical unit mass (kg/m <sup>3</sup> )					
Measured unit mass (kg/m <sup>3</sup> )					
Measured air content (%)					
Measured slump <sup>2</sup> (mm)					
Ambient temperature ( °C)					
Concrete temperature ( °C)					
<b>Measured Compressive Strengths (MPa):</b>					
Individual 7-day					
Individual 7-day					
Individual 7-day					
Average (7-day)					
Individual 28-day					
Individual 28-day					
Individual 28-day					
Average (28-day)					

<sup>1</sup> For normal mass portland cement concrete (2300 - 2500 kg/m<sup>3</sup>).

<sup>2</sup> Measure slump values on concrete before and after addition of high range water reducer if used.



## PORTLAND CEMENT CONCRETE MIX DESIGN<sup>1</sup> TRIAL BATCH SUMMARY

Project: Carson River Bridge Date: 04-05-00  
Contractor: Granite Construction Concrete for: Deck/Bridge/Drilled Piles  
Concrete producer: Capitol City Concrete Class of concrete: DE + Seal  
Mix designation: 401

### • COMPRESSIVE STRENGTH (28 DAY)

Minimum average strength required<sup>2</sup> ( $f_{cr}$ ) 4726 psi. ✓  
Design strength specified ( $f'_c$ ) 4000 psi. ✓

### • PROPORTIONS

Material	Specific Gravity (SSD)	SSD Wt. per m <sup>3</sup> (kg)	Absolute Volume (m <sup>3</sup> )	Tolerance % (±)	Admixtures	Dosage per m <sup>3</sup> (ml)
Cement	<u>3.15</u>	<u>312</u>	<u>0.099</u> ✓	1	Air entrainment	<u>204</u>
Water	1.000	<u>163</u>	<u>0.163</u> ✓	1	Water reducer	<u>1273</u>
Coarse aggregate <sup>3</sup>	<u>2.42</u>	<u>949</u>	<u>0.362</u> ✓	2	Retarder	_____
Fine aggregate <sup>3</sup>	<u>2.57</u>	<u>734</u>	<u>0.286</u> ✓	2	Color	_____
Total air			<u>0.055</u> ✓		Accelerator	_____
Other <u>Flyash</u>	<u>2.30</u>	<u>78</u>	<u>0.034</u> ✓		Other _____	_____
Admixtures	<u>1.000</u>	<u>15</u>	<u>0.001</u> ✓			
Totals:		<u>2238</u> kg	<u>1.000</u> m <sup>3</sup>			

### • PROPERTIES

Water-Cement ratio (by weight)<sup>4</sup> 0.45 ✓  
Measured unit weight 2239 kg/m<sup>3</sup>  
Theoretical unit weight 2238 kg/m<sup>3</sup>  
Measured air content 5.4 percent  
Measured slump 102 mm

### • MEASURED COMPRESSIVE STRENGTH

Individual 7-day, psi \_\_\_\_\_ Average (7 day): 3450 psi No data Provided  
Individual 28-day, psi \_\_\_\_\_ Average (28 day): 4815 psi 4193

<sup>1</sup> For normal weight Portland Cement Concrete (2300 - 2500 kg/m<sup>3</sup>).

<sup>2</sup> See page 5.

<sup>3</sup> Bulk SSD.

<sup>4</sup> The water cement ratio of mixes containing fly ash will be calculated using 60 % of the weight of the fly ash added to the weight of the cement prior to the determination.

### • SIGNATURES

Contractor: [Signature]  
Mix Designer: [Signature]

**PORTLAND CEMENT CONCRETE MIX DESIGN<sup>1</sup> (continued)**  
**MATERIALS SOURCE SUMMARY**

• **CEMENT (AASHTO M 85)**

Name and address of cement producer Cabrera's  
 Source of manufacture Redding, California

Type of cement Type I-II LA Materials certification attached ☒ Yes ☐ No

• **WATER (725.01 and AASHTO T 26)**

Water potable ☒ Yes ☐ No  
 or

If No, provide the following:

Water pH number: \_\_\_\_\_  
 Chloride concentration: \_\_\_\_\_ (ppm)  
 Sulphate ion concentration: \_\_\_\_\_ (ppm)  
 Total solids content: \_\_\_\_\_ (%)

• **ADMIXTURES**

Material	Producer and Product Designation	Certification Attached	
		Yes	No
Air entraining admixture	<u>Martin-Bulfinch Mixture</u>	<input checked="" type="checkbox"/> ✓	<input type="checkbox"/>
Water reducing admixture, type A	<u>Grace Dacrom 55</u>	<input checked="" type="checkbox"/> ✓	<input type="checkbox"/>
Retarding admixture, type B	_____	<input type="checkbox"/>	<input type="checkbox"/>
Accelerating admixture, type C	_____	<input type="checkbox"/>	<input type="checkbox"/>
Water reducing and retarding admixture, type D	_____	<input type="checkbox"/>	<input type="checkbox"/>
Water reducing and accelerating admixture, type E	_____	<input type="checkbox"/>	<input type="checkbox"/>
Water reducing, high range admixture, type F	<u>Grace Dacrom 19</u>	<input checked="" type="checkbox"/> ✓	<input type="checkbox"/>
Fly ash, type <u>FBC</u>	<u>I.S.G. (Bridge)</u>	<input checked="" type="checkbox"/> ✓	<input type="checkbox"/>
Color additive	_____	<input type="checkbox"/>	<input type="checkbox"/>
Other: _____	_____	<input type="checkbox"/>	<input type="checkbox"/>

<sup>1</sup> For normal weight portland cement concrete (2300 - 2500 kg/m<sup>3</sup>).

# PORTLAND CEMENT CONCRETE MIX DESIGN<sup>1</sup> (continued)

## MATERIALS SOURCE SUMMARY

### • COARSE AGGREGATE (703.02 AND AASHTO M 80)

Name of supplier/producer Granite Construction  
 Location of material source Dayton Pit  
 Material type ☐ Gravel ☒ Crushed gravel ☐ Crushed stone ☐ Crushed blast furnace slag  
 Grading No. C-7

#### Sieve Analysis:

Sieve Designation	Percent Passing	Specification
50 mm	<u>100</u>	—
37.5 mm	<u>100</u>	—
25.0 mm	<u>100</u>	<u>100</u>
19.0 mm	<u>95</u>	<u>90-100</u>
12.5 mm	<u>59</u>	—
9.5 mm	<u>27</u>	<u>20-55</u>
4.75 mm	<u>8</u>	<u>0-10</u>
2.36 mm	<u>3</u>	<u>0-5</u>
1.18 mm	<u>1</u>	—

#### Properties:

- (1) Coal and lignite 0 (%) (0-0.5)<sup>1</sup>
- (2) Deleterious chert 0 (%) (0-3)<sup>1</sup>
- (3) Sodium sulfate soundness<sup>2</sup> 5.0 (%) (0-12)<sup>3</sup> 1
- (4) Clay lumps and friable particles 0.5 (%) (0-2)<sup>3</sup> —
- (5) LA abrasion C-13, grading B, 19.8% loss (0-50)<sup>3</sup> 12
- (6) Bulk specific gravity —
- (7) Absorption 2.7 (%) 1.7
- (8) Bulk SSD specific gravity 2.62 256
- (9) Dry rodded unit weight 94.7 (kg/m<sup>3</sup>) 94
- (10) Minus 75  $\mu$ m 0.5 (%) (0-1)<sup>3</sup>
- (11) Adherent Fines — (%)
- (12) Other —

### • FINE AGGREGATE (703.01 AND AASHTO M 6)

Name of supplier/producer Granite Construction  
 Location of material source Dayton Pit  
☐ Manufactured sand ☐ Natural sand ☒ Blend

#### Sieve Analysis:

Sieve Designation	Percent Passing	Accumulative Percent Retained
9.5 mm	<u>100</u>	<u>100</u>
4.75 mm	<u>100</u>	<u>95-100</u>
2.36 mm	<u>82</u>	<u>80-100</u>
1.18 mm	<u>59</u>	<u>50-85</u>
600 $\mu$ m	<u>37</u>	<u>25-60</u>
300 $\mu$ m	<u>14</u>	<u>10-30</u>
150 $\mu$ m	<u>5</u>	<u>2-10</u>

#### Properties:

- (1) Clay lumps 0.3 (%) (0-3)<sup>3</sup> —
- (2) Coal and lignite 0 (%) (0-1)<sup>3</sup> —
- (3) Sodium sulfate soundness<sup>2</sup> 9.6 (%) (0-10)<sup>3</sup> 3
- (4) Sand equivalent value, alt. 2 — (>75)<sup>3</sup> 80
- (5) Bulk specific gravity —
- (6) Bulk SSD specific gravity 2.57 2.60
- (7) Absorption 4.3 (%) 1.9
- (8) Organic impurities Less than Plate 1 Clear
- (9) Minus 75  $\mu$ m 2.8 (%) (0-3)<sup>3</sup>
- (10) Other —

Fineness modulus: 2.88 (3.03)

<sup>1</sup> For normal weight portland cement concrete (2300 - 2500 kg/m<sup>3</sup>).

<sup>2</sup> At five cycles.

<sup>3</sup> Specification limits.

MIX NO. 67 P/C 3: 0

PORTLAND CEMENT CONCRETE MIX DESIGN<sup>1</sup> (continued)  
DATA FOR COMPUTING THE COEFFICIENT OF VARIATION OF BATCHES

Batch <sup>2</sup> No.	Date Batched	7-Day Compressive Strengths (psi)				28-Day Compressive Strengths (psi)			
		Cyl. 1	Cyl. 2	Cyl. 3	Average ( $\bar{x}$ )	Cyl. 1	Cyl. 2	Cyl. 3	Average ( $\bar{x}$ )
1	7/30/99					4600	4630		4615
2	8/2/99					3860	3750		3805
3	8/12/99					3500	3640		3570
4	8/16/99					3820	3890		3855
5	9/10/99					3610	3750		3680
6	9/14/99					4950	4530		4740
7	9/16/99					3180	3290		3235
8	9/20/99					4530	4630		4580
9	9/24/99					4140	3960		4050
10	9/29/99					3710	3780		3745
11	10/5/99					4100	4670		4135
12	10/8/99					5230	5130		5180
13	10/12/99					4140	4390		4265
14	10/25/99					4460	4460		4460
15	11/2/99					3710	3780		3745
16	11/13/99					4630	4600		4615
17	11/29/99					4390	4240		4315
18	12/1/99					3860	3780		3820
19	12/3/99					4850	4770		4810
20	12/9/99					4530	4740		4635

<sup>1</sup> For normal weight portland cement concrete (2300 - 2500 kg/m<sup>3</sup>).

<sup>2</sup> Batches to be consecutive and a minimum of 7.5 cubic meters each.

$$\bar{X} = \frac{\sum X}{N} = \frac{4193}{20} = 4193 \text{ (psi)}$$

$$s = \sqrt{\frac{N \sum (X^2) - (\sum X)^2}{N(N-1)}} = 505$$

Where:

- X = The 28-day batch average of at least 2 cylinders (3 preferred).
- $\bar{X}$  = The mean of the averages of 28-day compressive results.
- s = The sample standard deviation of the 28-day batch averages.
- N = The number of batches sampled.

PORTLAND CEMENT CONCRETE MIX DESIGN<sup>1</sup> (continued)  
DETERMINATION OF MINIMUM MIX DESIGN COMPRESSIVE STRENGTH

---

• MINIMUM MIX DESIGN COMPRESSIVE STRENGTH ( $f_{cr}$ )

Computed values from page 4:

$$\bar{X} = \frac{4193}{\text{for Mix 67 } f'_c = 3000} \text{ (psi)} \quad s = \frac{505}{\text{for } A = \text{Seal } f'_c = 24 \text{ MPa} = 3500 \text{ psi}}$$

Where:

$s$  = The sample standard deviation of the 28-day compressive strength test results from page 4.

$\bar{X}$  = The mean of the 28-day compressive strength test results from page 4.

$V$  = The coefficient of variation<sup>2</sup> expressed as a decimal and calculated as follows:

$$V = \frac{s}{\bar{X}} = \frac{505}{4193} = \frac{0.1204}{\text{for } f'_c = 4000} \text{ or } 0.15^2$$

$$f_{cr} = \frac{f'_c}{1 - kV} = \frac{4000}{1 - 1.28(.12)} = \frac{4726}{\text{psi.}}$$

Where:

$f'_c$  = The 28-day design compressive strength specified in the contract.

$k$  = A constant (1.28) for a probability that not more than 1 in 10 tests will fall below the specified compressive strength ( $f'_c$ ).

---

<sup>1</sup> For normal weight portland cement concrete (2300 - 2500 kg/m<sup>3</sup>).

<sup>2</sup> Use 0.15 for the coefficient of variation when there is insufficient test data available.

**PORTLAND CEMENT CONCRETE MIX DESIGN<sup>1</sup> (continued)**  
**LABORATORY TRIAL BATCH MIX DESIGN SUMMARY**

Description	Equivalent Batch Weights (SSD weight/m <sup>3</sup> )				
	Batch 1	Batch 2	Batch 3	Batch 4	Batch 5
<b>Materials:</b>					
Cement (kg)	312				
Water (kg)	143				
Coarse aggregate (kg)	949				
Fine aggregate (kg)	734				
Air entrainer (ml)	204				
Water reducer (ml)	1273				
Plasticizer (ml)	—				
Other <u>Flyash</u>	78				
<b>Properties:</b>					
Water/Cement Ratio <i>Use 60% - 1 by weight in total + Flyash</i>	0.45 0.42				
Theoretical unit wt. (kg/m <sup>3</sup> )	2238				
Measured unit wt. (kg/m <sup>3</sup> )	2239				
Measured air content (%)	5.4				
Measured slump <sup>2</sup> (mm)	102				
Ambient temperature (°C)	23				
Concrete temperature (°C)	20				
<b>Measured Compressive Strengths: (psi)</b>					
Individual 7-day					
Individual 7-day					
Individual 7-day					
Average (7-day)	3450				
Individual 28-day					
Individual 28-day					
Individual 28-day					
Average (28-day)	4815				

<sup>1</sup> For normal weight portland cement concrete (2300 - 2500 kg/m<sup>3</sup>).

<sup>2</sup> Measure slump values on concrete before and after addition of water reducer or plasticizer if used.



## NEVADA CEMENT COMPANY

Post Office Box 840, Fernley, Nevada 89408 - 0840 (775) 575-2281

### LABORATORY TEST REPORT

Date: February 2000

SAMPLE : TYPE I/II (Low-Alkali)

Silo: \_\_\_\_\_

Customer: \_\_\_\_\_

Bill of Lading: \_\_\_\_\_

<b>CHEMICAL ANALYSIS (%)</b> ASTM C-114	
Silicon Dioxide	21.0
Aluminum Oxide	4.3
Ferric Oxide	2.4
Magnesium Oxide	2.8
Sulfur Trioxide	3.1
Loss on Ignition	1.2
Insoluble Residue	0.49
Total Equ. Alk. as Na <sub>2</sub> O	0.37

<b>PHYSICAL TESTS</b>	
Specific Surface (Blaine) m <sup>2</sup> /kg ASTM C-204	365
Autoclave Expansion, % ASTM C-151	0.01
Set Times Vicat Needles ASTM C-191	
Initial Set Min.	105
Final Set Min.	240
Air Content, % ASTM C-185	5

<b>COMPOUND COMPOSITION (%)</b> ASTM C-150	
Tricalcium Aluminate	7


<b>COMPRESSIVE STRENGTHS (P.S.I.)</b> ASTM C-109	
3 Day MPa, (psi)	
7 Day MPa, (psi)	

NEVADA CEMENT COMPANY complies with the requirements of current ASTM C150 specifications for type I and type II low-alkali cement.

Cement analysis are reported as oxides, in accordance with ASTM test methods C114.

Silicon dioxide (SiO<sub>2</sub>) is present in the combined state as the compounds tricalcium silicate and dicalcium silicate, and not as crystalline silica. This cement may contain processing additions which meet the requirements of ASTM C465. Compliance documents for these processing additions are available upon request. All test results are certified to comply with the type specification designated.

We are not responsible for improper use or workmanship.

  
J. H. Legate  
Chief Chemist



# COMMERCIAL TESTING LABORATORIES

A DIVISION OF CTL/THOMPSON, INC.

TEST NUMBER: 23999 JOB NUMBER: CT-5208 REPORT DATE: 12/7/99

PORT TO: I.S.G. Resources  
950 Andover Park East

Tukwila WA 98188

PORT OF ORIGIN: Bridger  
PILE ID: 100R

TEST:

TEST DATE: 11/8/99

ASTM: C 618-97  
SPECIFICATIONS

TEST RECEIVED: 11/8/99

CHEMICAL COMPOSITION (%):		CLASS F	CLASS C
SILICON DIOXIDE:	60.38		
ALUMINUM OXIDE:	17.47		
IRON OXIDE:	5.26		
TOTAL SILICA, ALUMINUM, IRON:	83.11	70.0 Min	50.0 Min
SULFUR TRIOXIDE:	0.47	5.0 Max	5.0 Max
CALCIUM OXIDE:	8.26		
MOISTURE CONTENT:	0.04	3.0 Max	3.0 Max
LOSS ON IGNITION:	0.17	6.0 Max	6.0 Max

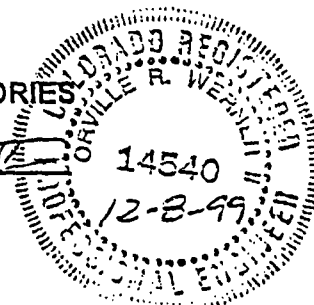
## PHYSICAL TEST RESULTS:

FINENESS, RETAINED ON #325 SIEVE, (%):	25.25	34 Max	34 Max
STRENGTH ACTIVITY INDEX WITH PORTLAND CEMENT (%)			
RATIO TO CONTROL @ 7 DAYS:	85.2		
RATIO TO CONTROL @ 28 DAYS:	97.6	75 Min	75 Min
WATER REQUIREMENT, % OF CONTROL:	96.6	105 Max	105 Max
SOUNDNESS, AUTOCLAVE EXPANSION (%):	0.071	0.8 Max	0.8 Max
DENSITY:	2.35		

COMMERCIAL TESTING LABORATORIES

BY

ORVILLE R. WERNER II, P.E.



22 LIPAN STREET

DENVER, COLORADO 80223

303 / 825-0777

This test report relates only to the items tested and shall not be reproduced, except in full, without written approval of Commercial Testing Laboratories

Master Builders, Inc.  
11325 Sunrise Gold Cr. Suite C  
Rancho Cordova, CA 95742  
Phone: 1-800-992-9950



March 6, 2000

**Certificate of Conformance**  
**Micro-Air**  
**Master Builders Air-Entraining Admixture for Concrete**

**TO WHOM IT MAY CONCERN:**

I, Alice McFarland, Manager, Quality Assurance for Master Builders, Inc., Cleveland, Ohio, certify:

That Micro-Air is Master Builders air-entraining admixture for concrete; and

That no calcium chloride or chloride based ingredient is used in the manufacture of Micro-Air; and

That Micro-Air, based on the chlorides originating from all the ingredients used in its manufacture, contributes less than 0.0001 percent (1.0 ppm) chloride ions by weight of the cement when used at the rate of 65 ml per 100 kg (1 fluid ounce per 100 pounds) of cement; and

That Micro-Air meets the requirements of ASTM C 260-94, Corps of Engineers' CRD-C 13-94, and AASHTO M154-89, the Standard Specifications for Air-Entraining Admixtures for Concrete.

Alice McFarland

A handwritten signature in cursive script that reads 'Alice McFarland'.

Manager, Quality Assurance  
Research and Development

# MICRO-AIR®

*Admixture for entraining air in concrete*



## DESCRIPTION:

MICRO-AIR air-entraining admixture provides concrete with extra protection by creating ultrastable air bubbles that are strong, small and closely spaced—a characteristic especially useful in the types of concrete known for their difficulty to entrain and maintain the air content desired.

Even when used at a lower dosage rate than standard air-entraining admixtures, MICRO-AIR meets the requirements of ASTM C 260, AASHTO M 154, CRD-C 13 and other Federal and State specifications.

## ADVANTAGES OF AIR ENTRAINMENT:

The entrainment of optimum air content in concrete results in the following improvements in concrete quality:

- Increased resistance to damage from freeze/thaw cycles and to scaling from deicing salts<sup>1</sup>
- Reduced permeability—increased watertightness
- Reduced segregation and bleeding
- Improved plasticity and workability

<sup>1</sup>Concrete durability research has established that the best protection for concrete from the adverse effects of freeze/thaw cycles and deicing salts results from: • proper air content in the hardened concrete; • a suitable air-void system in terms of bubble size and spacing; and • adequate concrete strength, assuming the use of sound aggregates and proper mixing, placing, handling and curing techniques.

When unusually low or high amounts of an air-entraining admixture are required to achieve normal ranges of air content or if the required amount of air-entraining admixture necessary to achieve required levels of air content is observed to change significantly under given conditions, the reason should be investigated. In such cases, it is especially important to determine: (a) that a proper amount of air is contained in the fresh concrete at the point of placement; and (b) that a suitable air-void system (spacing factor) is being obtained in the hardened concrete.

## ADVANTAGES OF MICRO-AIR:

- Greatly improved stability of air-entrainment
- Improved air-void system in hardened concrete
- Improved ability to entrain and retain air in low-slump concrete; concrete containing high-carbon content fly ash; concrete containing large amounts of fine materials; concrete using high-alkali cements; high-temperature concrete; and concrete with extended mixing times

## FEATURES/BENEFITS:

**Ready to Use**—Solution is the proper concentration for rapid, accurate dispensing.

**Compatible for Use**—MICRO-AIR admixture is compatible with concrete containing other admixtures—water-reducers, high-range water-reducers, accelerators, retarders, and water repellents.

The use of MICRO-AIR air-entraining admixture with Master Builders water-reducing, set-controlling admixtures forms a desirable combination for producing the highest quality, normal or lightweight concrete. Heavyweight concrete normally does not contain entrained air.

**NOTE:** As stated in ACI 212 and other publications, when two or more admixtures are used, they must be added to the mix separately (through dispensers or manually) and must not be mixed with each other prior to adding to the concrete mix.

For optimum, consistent performance, the air-entraining admixture should be dispensed on damp, fine aggregate or with the initial batch water. When using lightweight aggregate, field evaluations should be conducted to determine the best method to dispense the air-entraining admixture.

## USAGE INFORMATION:

Add MICRO-AIR admixture to the concrete mix using a dispenser designed for air-entraining admixtures; or add manually using a suitable measuring device that ensures accuracy within plus or minus 3% of the required amount.

Measure the air content of the trial mix and either increase or decrease the quantity of MICRO-AIR admixture to obtain the desired air content in the production mix. Check the air content of the first batch and make further adjustments if needed. Due to possible changes in the factors that affect the dosage rate of MICRO-AIR, frequent checks should be made during the course of the work. Adjustments to the dosage should be based on the amount of entrained air in the mix at the point of placement.



## QUANTITY TO USE:

There is no standard dosage rate for MICRO-AIR admixture. The exact quantity of air-entraining admixture needed for a given air content of concrete is not predictable because of differences in concrete making materials. Typical factors which might influence the amount of air entrained are: temperature, cement, sand grading, mix proportions, slump, means of conveying and placement, use of extra fine materials such as fly ash, etc.

The amount of MICRO-AIR admixture used will depend upon the amount of entrained air required under actual job conditions. In a trial mix, use 1/8 to 1-1/2 fl oz/100 lb (8 to 98 mL/100 kg) of cement. In mixes containing water-reducing, set-controlling admixtures, the amount of MICRO-AIR needed is somewhat less than the amount required in plain concrete. In mixes requiring a higher or lower dosage to obtain the desired air content, consult your local Master Builders representative.

## AIR CONTENT DETERMINATION:

The total air content of normal weight concrete should be measured in strict accordance with ASTM C 231, "Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method" or ASTM C 173, "Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method." The air content of lightweight concrete could only be determined using the Volumetric Method.

The air content should be verified by calculating the gravimetric air content in accordance with ASTM C 138, "Unit Weight, Yield, and Air Content (Gravimetric) of Concrete." If the total air content, as measured by the Pressure Method or Volumetric Method and as verified by the Gravimetric Method, deviates by more than 1-1/2%, the cause should be determined and corrected through equipment calibration or by whatever process is deemed necessary.

## TEMPERATURE PRECAUTION:

MICRO-AIR admixture should be stored and dispensed at 35 °F (2 °C) or higher. Although freezing does not harm this product, precautions should be taken to protect it from freezing. If it freezes, thaw and reconstitute by mild mechanical agitation. Do not use pressurized air for agitation.

## PACKAGING:

MICRO-AIR admixture is supplied in 55 U.S. gallon (208 liter) drums and bulk delivery.

## CAUTION:

MICRO-AIR admixture is a CAUSTIC solution. Chemical goggles and gloves are recommended if transferring or handling large quantities of material. (See MSDS and/or product label for complete information.)

## NON-CHLORIDE, NON-CORROSIVE:

MICRO-AIR admixture will not initiate or promote corrosion of reinforcing steel embedded in concrete, prestressed concrete or concrete placed on galvanized steel floor and roof systems. Calcium chloride is not an added ingredient in the manufacture of MICRO-AIR admixture. Based on the chlorides originating from all ingredients used in manufacture, MICRO-AIR admixture contributes less than 0.0001% (1.0 ppm) chloride ions by weight of the cement when used at the rate of 1 fl oz per 100 lb (65 mL per 100 kg) of cement.

For suggested specification information or for additional product data on MICRO-AIR air-entraining admixture, contact your local Master Builders representative.

### Master Builders, Inc.

#### United States

23700 Chagrin Boulevard  
Cleveland, Ohio 44122-5554  
(300) MBT-9990  
Fax (216) 831-6910

#### Canada

3637 Weston Road  
Toronto, Ontario M9L 1W1  
(800) 387-5862  
Fax (416) 741-7925

#### Mexico

Blvd. M. Avila Camacho 80, 3er Piso  
53390 Naucalpan, México  
011-525-557-5544  
Fax 011-525-395-7903

# GRACE

## Grace Construction Products

W.R. Grace & Co.-Conn.  
293 Wright Brothers Avenue  
Livermore, CA 94550

(925) 443-9700  
(925) 443-9701 Fax

January 14, 2000

Bear River Contractors  
dba Capitol City Concrete  
2505 Akron Way  
Carson City, NV 89701

Gentlemen:

This is to certify that DARACEM® 55, a mid-range water reducing admixture, as manufactured and supplied by Grace Construction Products, W. R. Grace & Co.-Conn., is formulated to comply with Specification for Chemical Admixtures for Concrete, ASTM Designation: C 494, Type A (AASHTO M 194, Type A).

DARACEM® 55 does not contain calcium chloride or chloride containing compounds as a functional ingredient. Chloride ions may be present in trace amounts contributed from the domestic water supply used during the manufacturing process.

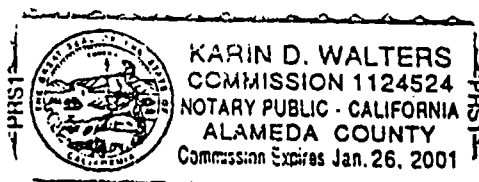
The foregoing is in addition to and not in substitution for our standard Conditions of Sale printed on the reverse side hereof.



Michael Gardner  
Technical Service Manager  
Authorized Signature

STATE OF CALIFORNIA  
COUNTY OF ALAMEDA

*Subscribed and sworn to, before me, on January 14, 2000.*

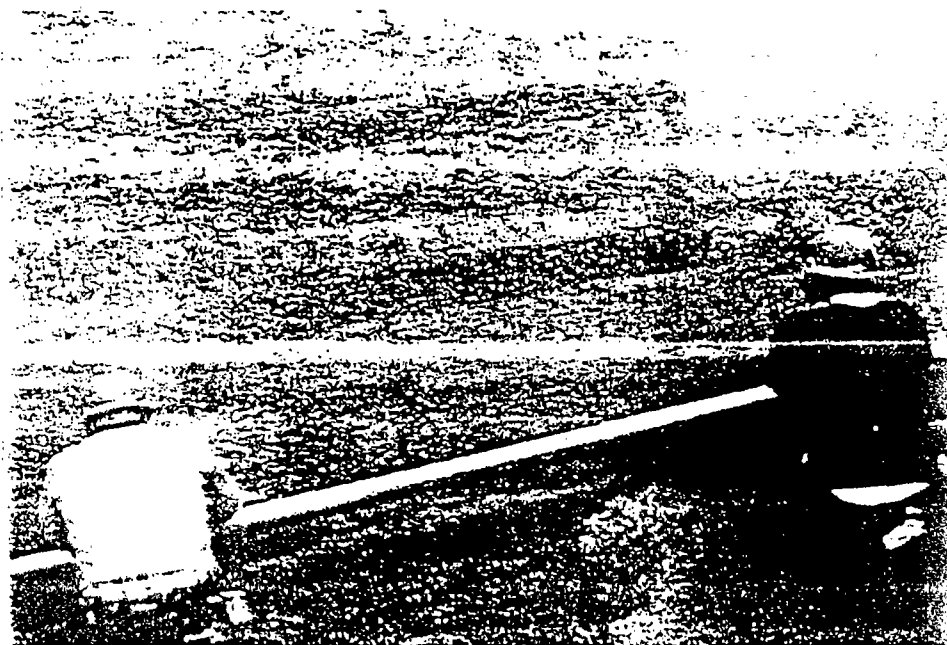
  
Notary Public

# Daracem® 55

Mid-Range Water-Reducing Admixture ASTM C 494, Type A

Daracem® 55 is a mid-range water-reducer specifically formulated to produce concretes with dramatically enhanced finishing characteristics and normal setting times. Effective through a wide addition rate range, Daracem 55 combines the benefits of normal and high range water reducers allowing for the ultimate control of the concrete's placing and finishing properties.

Daracem 55 is an aqueous solution of complex organic compounds, each of which contributes uniquely to the concrete's final properties. It contains both patented dispersing and patented finishability agents that provide performance superior to conventional water-reducing products. Daracem 55 is also formulated with a catalyst which promotes more complete hydration of portland cement to assure superior strength performance. It is manufactured under rigid controls which provide uniform, predictable performance. Daracem 55 contains no calcium chloride. Supplied as a dark brown, low viscosity liquid, one Liter weighs approximately 1.28 kg (10.7 lb/gal).



Daracem 55 produces a concrete with lower water content, improved placement properties, and enhanced finishability. It yields a less permeable and more durable concrete. Daracem 55 is used in ready mix, job site, and concrete paving plants for normal and lightweight concrete, in block and precast. It imparts a "slickness" to the surface of the concrete making it most appropriate for concrete flatwork as well as slip form work. Daracem 55 is

also particularly effective in lean or fly ash and slag compensated mixes.

Daracem 55 offers significant advantages over conventional water reducers. Laboratory and field work has consistently demonstrated:

- **Ultimate Workability and Finishability**  
The exceptional water-reducing capabilities allow for concrete production at higher slumps

**GRACE**  
Construction Products

with better water retention and internal cohesiveness, providing a less "sticky" concrete with improved placement properties. Formulated with proven finishing enhancing components, Daracem 55 controls bleeding while bringing the mortar to the surface. Finishers have stated that the concrete has improved trowelability. The influence of Daracem 55 on the finishability of lean mixes has been particularly noticeable. Floating and troweling, by machine or by hand, easily imparts a smooth, close tolerance surface with less machine time and labor.

- **Neutral Setting Times**  
Formulated with a set control agent, Daracem 55 provides normal setting characteristics throughout its addition rate range. This allows for increased water reduction and increased slump without significantly extended setting times. It also allows the flexibility to vary addition based on specific job and weather requirements.
- **Superior Strength Performance**  
The water reduction properties, up to 12%, and dispersion characteristics allow the production of lower water to cement ratio concretes and more complete hydration. The combined effect is increased compressive and flexural strengths at all ages.

#### **Addition Rate**

The addition rate range of Daracem 55 is 190 to 590 mL/100 kg (3 to 9 fl oz/100 lb) of cement. Typically excellent results are achieved between 325 to 460 mL/100 kg (5 to 7 fl oz/100 lb) of cement. Optimum addition depends on the other concrete mixture components, job conditions, and desired performance characteristics.

#### **Compatibility with Other Admixtures**

Daracem 55 is compatible with all air-entraining admixtures such as Darex® II AEA and Daravair®. Due to a synergistic effect of Daracem 55, the amount of air-entraining may be reduced by 25 to 50% when added to concrete with Daracem 55. By combining the separate effects of air entrainment and dispersion, the water requirement of concrete may be reduced up to 15%. Each admixture should be added to the concrete separately.

#### **Dispensing Equipment**

A complete line of accurate, automatic dispensing equipment is available. Daracem 55 may be added to the concrete mix on the sand or in the batch water.

#### **Packaging**

Daracem 55 is available in bulk, delivered in metered tank trucks, and 210 L (55 gal) drums.

Daracem 55 contains no flammable ingredients. It will freeze at approximately -9°C (15°F) but will return to full strength after thawing and thorough mechanical agitation.

#### **Architects' Specifications**

Concrete shall be designed in accordance with Standard Recommended Practice for Selecting Proportions for Concrete, ACI 211.

The water-reducing admixture shall be a mid-range water-reducing admixture such as Daracem 55 as manufactured by Grace Construction Products, or its equivalent. The admixture shall not contain calcium chloride. It shall meet the requirements of Specification for Chemical Admixtures for Concrete ASTM Designation C 494 as a Type A admixture. Certification of compliance shall be made available on request. The admixture shall be considered part of the total mixing water.

The admixture shall be delivered as a ready-to-use liquid product and shall require no mixing at the batching plant or job site.

**W.R. Grace & Co.-Conn. 62 Whittemore Avenue Cambridge, MA 02140**

Daracem, Darex and Daravair are registered trademarks of W.R. Grace & Co.-Conn.

We hope the information here will be helpful. It is based on data and knowledge considered to be true and accurate and is offered for the user's consideration, investigation and verification, but we do not warrant the results to be obtained. Please read all statements, recommendations or suggestions in conjunction with our conditions of sale, which apply to all goods supplied by us. No statement, recommendation or suggestion is intended for any use which would infringe any patent or copyright. W.R. Grace & Co.-Conn., 62 Whittemore Avenue, Cambridge, MA 02140. In Canada: W.R. Grace & Co. Canada, Ltd. 294 Clement Ave., North York, Ontario, Canada M1S 1C4.

This product may be covered by patents or patents pending. Copyright 1994 W.R. Grace & Co.-Conn. D5-12E Printed in U.S.A. 12/94 FACPS/10M

**GRACE**  
Construction Products

# WRDA®-19

## Superplasticizer

ASTM C 494 Type A & F



### DESCRIPTION:

WRDA®-19 is a high range water reducer, commonly referred to as a superplasticizer. It is an aqueous solution of a modified naphthalene sulfonate. It is a low viscosity liquid which has been formulated by the manufacturer for use as received. WRDA-19 contains no added chloride. WRDA-19 is formulated to comply with specifications for Chemical Admixtures for Concrete, ASTM Designation: C 494 as a Type A, or as a Type F admixture. One gallon of WRDA-19 weighs approximately 10 lbs. (1 L weighs approx. 1.2 kg).

### DISPERSION:

WRDA-19 is a superior dispersing admixture having a marked capacity to disperse the cement agglomerates normally found in a cement-water suspension. The capability of WRDA-19, in this respect, exceeds that of normal water-reducing admixtures.

### USES:

WRDA-19 produces concrete with extremely workable characteristics referred to as high slump, flowing concrete. WRDA-19 also allows concrete to be produced with very low water/cement ratios at low or normal slumps.

WRDA-19 is ideal for use in prestress, precast, bridge deck or any concrete where it is desired to keep the water/cement ratio to a minimum and still achieve the degree of workability necessary to provide easy placement and consolidation. WRDA-19 will also fluidize concrete making it ideal for tremie concreting or other applications where high slumps are desired.

### ADVANTAGES:

1. WRDA-19 can produce high slump flowable concrete at no loss in strength.
2. WRDA-19 can produce low water/cement ratio concrete and therefore, high strengths.
3. WRDA-19, in prestress/precast work, can be used to substantially reduce or eliminate the high energy requirements of external heat for accelerated curing.
4. WRDA-19 concrete produced with Type I cement may be substituted for normal concrete produced with Type III cement to achieve early release strengths.
5. WRDA-19 concrete, even at high slump, exhibits no significant segregation in comparison to concrete without a superplasticizer at the same slump.
6. WRDA-19 aids in rapid discharge of concrete from truck mixers thereby reducing on the job time and improving mixer utilization.

### ADDITION RATES:

Addition rates of WRDA-19 can vary with type of application, but will normally range from 6 to 20 fluid ounces per 100 lbs. (390 to 1300 ml/100 kg) of cement. In most instances the addition of 10 to 16 fluid ounces per 100 lbs. (650 to 1040 ml/100 kg) of cement will be sufficient. At a given water/cement ratio, the slump required for placement can be controlled by varying the addition rate. Should job site conditions require using more than recommended addition rates, please consult your Grace Representative.

### COMPATIBILITY:

In concrete containing WRDA-19, the use of an air-entraining agent (such as Daravair® or Darex® II AEA) is recommended to provide suitable air void parameters for resistance against freeze-thaw attack.

Most Type A water reducers or Type D water-reducing retarders are compatible with WRDA-19 as long as they are separately added to the concrete. Pretesting of the concrete should be performed to optimize dosages and addition times of these admixtures. Caution should be exercised when using WRDA-19 together with a retarder, as excessive retardation can occur if the admixture dosages are too high.

Pretesting of the concrete should be performed to determine dosages and addition times of these admixtures. The admixtures should not contact each other before they enter the concrete.

### PACKAGING:

WRDA-19 is available in bulk, delivered by metered tank trucks, and in 55 gallon (210 L) drums. WRDA-19 contains no flammable ingredients.

It will begin to freeze at approximately 32°F (0°C), but will return to full strength after thawing and thorough agitation.

In storage, and for proper dispensing, WRDA-19 should be maintained at temperatures above 32°F (0°C).

Copyright 1993, W.R. Grace & Co., Conn.

We hope the information given here will be helpful. It is based on data and knowledge considered to be true and accurate and is offered for the user's consideration, investigation and verification but we do not warrant the results to be obtained. Please read all statements, recommendations or suggestions in conjunction with our conditions of sale which apply to all goods supplied by us. No statement, recommendation or suggestion is intended for any use which would infringe any patent or copyright. Grace Construction Products, W.R. Grace & Co., Conn., 62 Whittemore Avenue, Cambridge, MA 02140.

**GRACE**  
Construction Products

# GRACE

## Grace Construction Products

W.R. Grace & Co.-Conn.  
293 Wright Brothers Avenue  
Livermore, CA 94550

(925) 443-9700  
(925) 443-9701 Fax.

January 14, 2000

Bear River Contractors  
dba Capitol City Concrete  
2505 Akron Way  
Carson City, NV 89701

Gentlemen:

This is to certify that DARACEM<sup>®</sup> 19, a high-range water reducing admixture, as manufactured and supplied by Grace Construction Products, W. R. Grace & Co.-Conn., is formulated to comply with Specification for Chemical Admixtures for Concrete, ASTM Designation: C 494, Type A and Type F (AASHTO M 194, Type A).

DARACEM<sup>®</sup> 19 does not contain calcium chloride or chloride containing compounds as a functional ingredient. Chloride ions may be present in trace amounts contributed from the domestic water supply used during the manufacturing process.

The foregoing is in addition to and not in substitution for our standard Conditions of Sale printed on the reverse side hereof.

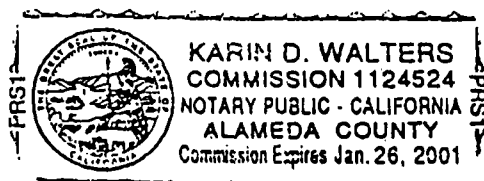


Michael Gardner  
Technical Service Manager  
Authorized Signature

STATE OF CALIFORNIA  
COUNTY OF ALAMEDA

*Subscribed and sworn to, before me, on January 14, 2000.*

  
NOTARY PUBLIC





Division of Kiewit Western Co.

# Concrete Mix Design

3052 S. 19th Avenue, Phoenix, AZ 85009-6926  
P.O. Box 20128, Phoenix, AZ 85036-0128  
602/262-1360 FAX 602/262-1374

DATE: March 31, 2000

PROJECT: Carson River Bridge  
# NV-ERFO-BIA-WASH 1 (1)

Tpac Job No. 2624

REC'd  
4/18/00

CONTRACTOR: Kie-Con

Products:  
Type III Girders

The following is the concrete mix we propose for the precast and/or prestressed products for the referenced project, to produce a minimum 28 day strength of 45 MPA when placed at a 102 mm. slump +/- 25mm. fci = 41 MPa. Aggregate to be supplied by San Xavier Rock & Materials, Cortaro Plant.

## SSD BATCH WEIGHTS PER CUBIC METER

DESIGN NUMBER: 2248M

CLASS: P

MATERIALS:	SSD WEIGHTS Kg / M3	VOL. M3
------------	---------------------	---------

Cement: ARIZONA PORTLAND II	446	0.142
Pozz :		
Water : 121 Liters	156	0.156
W/C : 0.35		

### AGGREGATES:

Coarse Agg. 1 : ASTM C-33 SIZE No. 67	1060	0.409
Coarse Agg. 2 :		
Coarse Agg. 3 :		
Fine Agg. 1 : 2.80 ASTM C-33	707	0.273
Fine Agg. 2 :		

### ADMIXTURES :

Admixture 1 : MASTER BUILDERS 80	1.16 L	0.000
Admixture 2 : MASTER BUILDERS RHEOBUILD 1000	4.37 L	0.000
Admixture 3 :		
Admixture 4 :		

Air Content : ENTRAPPED : 2.0%		0.020
--------------------------------	--	-------

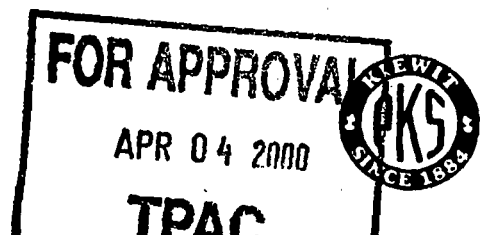
TOTALS:	2369	1.000
---------	------	-------

Plastic Unit Wt. : 2369 Kg / M3

S.G. Coarse : 2.59 Fine : 2.59

SUBMITTED BY: Richard H. Nelson  
Richard H. Nelson, Div. Quality Control Mgr.

Building tomorrow today.



poi



Division of Kiewit Western Co.

3052 S. 19th Avenue, Phoenix, AZ 85009-6926  
P.O. Box 20128, Phoenix, AZ 85036-0128  
602/262-1360 FAX 602/262-1374

March 31, 2000

Job Name: CARSON RIVER BRIDGE  
# NV-ERFO-BIA-WASH 1 (1)

TPAC Job Number: 2624

Contractor: KIE-CON

Products: TYPE III GIRDERS

The following is the concrete mix we propose for the precast and/or prestressed products for the referenced project, to produce a minimum 28-day strength of 6525 psi when placed at a 4 in. slump +/- 1" in. fci = 5945 psi. Aggregate to be supplied by San Xavier Rock and Materials, Cortaro Plant.

# SSD Batch Weights per Cubic Yard

Mix Design:	2248		Class: P
Materials:		SSD Wt./LBS/CY	ABS Vol, CF
Cement Type:	ARIZONA PORTLAND II	752	3.83
Pozzolan Type:		0	0.00
Water:	32 Gallons	263	4.21
W/C:	0.35		
AGGREGATES			
Coarse Agg. 1	ASTM C-33 SIZE NO. 67	1786	11.05
Coarse Agg. 2		0	0.00
Coarse Agg. 3		0	0.00
Fine Agg 1:	2.80 ASTM C-33	1191	7.37
Fine Agg 2:		0	0.00
ADMIXTURES			
Admixture 1:	MASTER BUILDERS 80	30 oz	0
Admixture 2:	MASTER BUILDERS RHEOBUILD 1000	113 oz	0
Admixture 3:		0	0
Admixture 4:		0	0
Air Content:	ENTRAPPED: 2.0%		0.54
TOTALS		4135	27

Plastic Unit Weight: 147.9

SG Coarse: 2.59

SG Fine: 2.59

Submitted By:

Richard H. Nelson, Div. Quality Control Manager

FOR APPROVAL

APR 04 2000

TPAC



Building tomorrow today.

pci



Division of Kiewit Western Co.

3052 S. 19th Avenue, Phoenix, AZ 85009-6926  
P.O. Box 20128, Phoenix, AZ 85036-0128  
602/262-1360 FAX 602/262-1374

MixDesign: 2248  
Age at Test: 28-Day  
Design Strength: 6525  
Today's Date 03/31/00

Test Number	Cylinder 1 PSI	Cylinder 2 PSI	Average PSI	Range PSI	Date Cast
1	7800	7720	7760	80	02/09/00
2	7960	7880	7920	80	02/09/00
3	8670	8750	8710	80	02/07/00
4	8670	8670	8670	0	02/07/00
5	8040	7880	7960	160	02/07/00
6	8040	7960	8000	80	02/02/00
7	7800	8350	8075	550	02/02/00
8	8040	8350	8195	310	02/02/00
9	7720	7680	7700	40	02/02/00
10	8040	7960	8000	80	02/01/00
11	8510	8550	8530	40	02/01/00
12	7800	7720	7760	80	01/28/00
13	7800	7880	7840	80	01/28/00
14	7560	7640	7600	80	01/28/00
15	8270	8190	8230	80	01/25/00
16	7560	7720	7640	160	01/25/00
17	8270	8040	8155	230	01/25/00
18	7200	7400	7300	200	01/21/00
19	7360	7120	7240	240	01/21/00
20	7760	7880	7820	120	01/21/00
21	7480	7160	7320	320	01/19/00
22	7000	7320	7160	320	01/18/00
23	7080	7160	7120	80	01/18/00
24	7000	7400	7200	400	01/18/00
25	6920	7000	6960	80	01/14/00
26	7080	7120	7100	40	01/14/00
27	6680	6840	6760	160	01/14/00
28	6840	6760	6800	80	01/11/00
29	6960	7040	7000	80	01/11/00
30	7080	7000	7040	80	01/11/00



Page 2



pci



Division of Kiewit Western Co.

3052 S. 19th Avenue, Phoenix, AZ 85009-6926  
P.O. Box 20128, Phoenix, AZ 85036-0128  
602/262-1360 FAX 602/262-1374

MixDesign: 2248  
Age at Test: 28-Day  
Design Strength: 6525  
Today's Date 03/31/00

**Within Test Results**

Average Range: 147  
Standard Deviation: 130  
Coef of Variation: 1.70%

**Overall Results**

Average Strength 7,652  
Standard Deviation 549  
Coef of Variation 7.17%

Per ASTM C-94

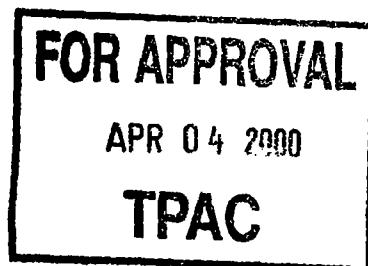
For a 1 in 10 chance of falling below the limit, this series of tests yields a design strength  $F'_C = 7303$  PSI

Per ACI 318 Sec. 5.3.1.1:

The design strength,  $f'_c = 6525$  PSI.

Required average compressive strength used as a basis for selection of concrete proportions,  $f'_c = 7260$

The actual test average is 7652 PSI which is 105% of the required average,  $f'_c$ .



Page 1

aci

*Building tomorrow today.*





# ARIZONA PORTLAND CEMENT COMPANY

*A Division of California Portland Cement Company*

Manufacturers of Arizona Cements

P. O. Box 338

Rillito, Arizona 85654-0338

Tel: (520) 682-2221 Fax: (520) 682-4345

## MANUFACTURER'S CERTIFICATION

Mr. Dick Nelson

*T-Pac*

P. O. Box 20128

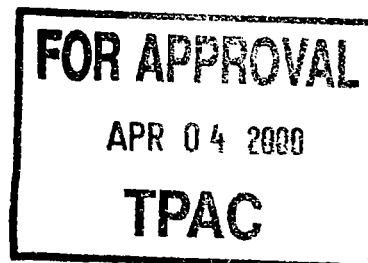
Phoenix, AZ 85036

We hereby certify that the following Type II, Low Alkali, Portland Cement lots have been shipped from the Arizona Portland Cement Company, Rillito Cement Plant, Rillito Arizona. All Type II cement is shipped from Rillito, Arizona and meets or exceeds the current ASTM C-150 specifications for Type I/II Low Alkali Cement.

Individual certifications can be obtained with each load upon request and delivered to your plant sites. These certifications will contain pertinent data including shipping lot number.

The Shipping Lot Numbers for the Month of **FEBRUARY 2000** are as follows:

03201S	04502	05702
03202	04602	06002
03302	04702	06102
03502	04802	06202
03802	04902	06302
03902	05202	06502
04002	05302	06702
04102	05502	06802
04202	05602	

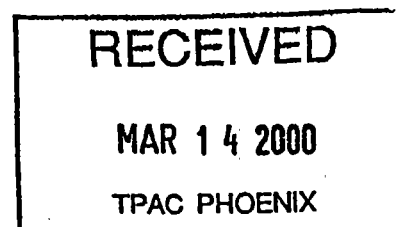


*William J. Phillips*

William J. Phillips  
Quality Control Supervisor

Date Signed: 12-Mar-00

File: Type II Data.doc





# ARIZONA PORTLAND CEMENT COMPANY

A Division of California Portland Cement Company

Manufacturers of Arizona Cements

P. O. Box 338

Rillito, Arizona 85654-0338

Tel: (520) 682-2221 Fax: (520) 682-4345

## CERTIFICATE OF TEST

Arizona Portland Cement Type II Low Alkali

A.S.T.M. Designation: C 150

certify that the Type I/II Low Alkali Cement produced and shipped from the Rillito Plant meets or exceeds all current ASTM 50 requirements and specifications. The following represents the monthly average chemical and physical data for the month of BRUARY 2000.

CHEMICAL ANALYSIS (Oxides in %)		ASTM C-150 LIMITS
Iron Dioxide, $\text{SiO}_2$	20.98	20.0 min. %
Alumina Oxide, $\text{Al}_2\text{O}_3$	3.87	6.0 max. %
Iron Oxide, $\text{Fe}_2\text{O}_3$	3.44	6.0 max. %
Calcium Oxide, $\text{CaO}$	62.48	—
Magnesium Oxide, $\text{MgO}$	4.21	6.0 max. %
Sulfur Trioxide, $\text{SO}_3$	2.83	3.0 max. % (C3A less than 8.0)
Loss on ignition	1.24	3.0 max. %
Insoluble residue	0.37	0.75 max. %
Alkali Equivalent ( $\% \text{Na}_2\text{O} + 0.658\% \text{K}_2\text{O}$ )	0.47	0.60 max. %
POTENTIAL COMPOSITION		
Calcium Silicate, $3\text{CaO}:\text{SiO}_2$ (C3S)	56	—
Calcium Aluminate, $3\text{CaO}:\text{Al}_2\text{O}_3$ (C3A)	4	8 max. %
PHYSICAL ANALYSIS		
Fineness, Blaine, Specific Surface ( $\text{m}^2/\text{kg}$ )	402	280 min. ( $\text{m}^2/\text{kg}$ )
Percent passing 325 mesh screen (45 $\mu$ )	97.3	—
Specific Gravity ( $\text{H}_2\text{O}$ )	3.15	—
Compressive Strength, C-109, p.s.i.		
1 day	3980	1450 min. psi
3 days	4900	2470 min. psi
7 days (January Data)	6220	—
Autoclave expansion		
1 day	0.11	0.80 max. %
24 hr Set	83.8	50 min. % (optional)
Time of setting: Initial (minutes)	133	45 min. (minutes)
Content of Mortar (volume %)	5.6	12 max. %
Water	25.2	—

Remarks: Apparatus and methods in use in this laboratory have been checked by the National Institute of Standards and Technology. Major oxides are analyzed by X-ray Fluorescence Spectrometry.

**FOR APPROVAL**

APR 04 2000

**TPAC**

*William J. Phillips*

William J. Phillips  
Quality Control Supervisor

**Master Builders, Inc.**  
Western Region  
2126 E. Fifth Street  
Tempe, AZ 85281



**Certificate of Conformance**  
**Pozzolith 80 (Formerly MBL-80)**  
**Master Builders Admixture for Concrete**

February 15, 2000

**TO WHOM IT MAY CONCERN:**

I, Alice McFarland, Manager, Quality Assurance for Master Builders, Inc., Cleveland, Ohio, certify:

That Pozzolith 80 and MBL-80 are one and the same product, having identical composition and concentration, differing only in designation; and

That no calcium chloride or chloride based ingredient is used in the manufacture of Pozzolith 80; and

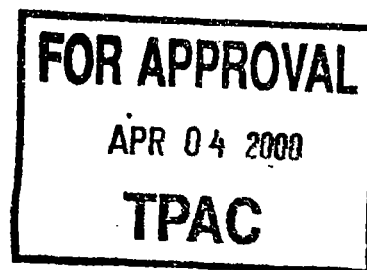
That Pozzolith 80, based on the chlorides originating from all the ingredients used in its manufacture, contributes less than 0.0002 percent (2.0 ppm) chloride ions by weight of the cement when used at the rate of 65 ml per 100 kg (1 fluid ounce per 100 pounds) of cement; and

That Pozzolith 80, depending upon the dosage used, meets the requirements for a Type A, Water-Reducing, Type B, Retarding, and Type D, Water-Reducing and Retarding Admixture specified in ASTM C 494-86 and Corps of Engineers' CRD-C 87-91, and AASHTO M194-87, the Standard Specifications for Chemical Admixtures for Concrete.

Alice McFarland

A handwritten signature in cursive script that reads "Alice McFarland".

Manager, Quality Assurance  
Research and Development



**Master Builders, Inc.**

Western Region  
2126 E. Fifth Street  
Tempe, AZ 85281



**Certificate of Conformance  
Rheobuild 1000  
Master Builders Admixture for Concrete**

**March 3, 2000**

**TO WHOM IT MAY CONCERN:**

I, Alice McFarland, Manager, Quality Assurance for Master Builders, Inc., Cleveland, Ohio, certify:

That no calcium chloride or chloride based ingredient is used in the manufacture of Rheobuild 1000; and

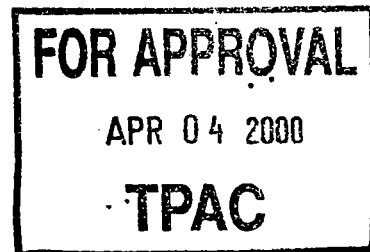
That Rheobuild 1000, based on the chlorides originating from all the ingredients used in its manufacture, contributes less than 0.00008 percent (0.8 ppm) chloride ions by weight of the cement when used at the rate of 65 ml per 100kg (1 fluid ounce per 100 pounds) of cement; and

That Rheobuild 1000 meets the requirements for a Type F, Water-Reducing, High Range Admixture, specified in ASTM C 494-92, Corps of Engineers' CRD-C 87-93, and AASHTO M194-87, the Standard Specifications for Chemical Admixtures for Concrete; and

That Rheobuild 1000 meets the requirements for a Type I, Plasticizing Admixture specified in ASTM C 1017-92, the "Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete".

Alice McFarland

Manager, Quality Assurance  
Research and Development



**Terracon**

355 S. Euclid Ave., Suite 107

Tucson, AZ 85719

(520) 770-1789

**Physical Properties of Aggregates**

Client Name: San Xavier Rock & Materials  
 Address: P.O. Box 551  
Cortaro, Arizona 85652

Project Name: Annual Quality Control  
 Location: \_\_\_\_\_

Sampled By: D. Cripe Date: 1/26/98  
 Submitted By: D. Cripe Date: 1/26/98

Project No.: 63981003-C3 Date of Report: 2/16/98  
 Sample I.D. No. or Description: \_\_\_\_\_

Aggregate Source: Cortaro, Plant 23

Aggregate Type: Concrete Sand

Reviewed By: J. D. Obenauer

**Sieve Analysis, ASTM C136****Test Standards are ASTM unless otherwise indicated**

Sieve Size	Passing  % Accumulative	Specification		Test	Standard	Results	Specifi- cation
		ASTM C33					
		Min.	Max.				
				Fineness Modulus	C125	2.94	2.3-3.1
				Dry Rodded Unit Wt, pcf	C29		
				Lightweight Pieces, % Conc/Lignite	C123		
9"				Clay Lumps & Friable, %	C142	0.0	5.0 Max
5"				Organic Impurities	C40	Clear	
4"				Sand Equivalent Value	C2419	89	75 Min
3"				LA Abrasion, % Grade	C131		
2"				Soundness-Mg, %loss	C88		
1-1/2"				Soundness-Na, %loss	C88	6	12 Max
1"				Fractured Face, % by Wt.			
3/4"				One or more			
1/2"				Two or more			
3/8"			100	Liquid Limit	D4318		
1/4"				Plasticity Index	D4318		
#4	100	95	100				
#8	86	80	100				
#10	80						
#16	61	50	85				
#30	37	25	60				
#40	27						
#50	17	10	30				
#100	5	2	10				
#200	0.6		5				
				Specific Gravity	Absorption, %	C128	1.62
					Bulk (Dry)	C128	2.576
					Bulk (SSD)	C128	2.617
					Apparent	C128	2.690

Comments:

Copies to:

**FOR APPROVAL**

APR 04 2000

**TPAC**

**Terracon**

355 S. Euclid Ave., Suite 107

Tucson, AZ 85719

(520) 770-1789

**Physical Properties of Aggregates**

Client Name: San Xavier Rock & Materials  
 Address: P.O. Box 551  
Cortaro, Arizona 85652

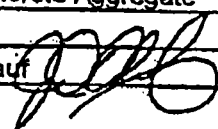
Project Name: Annual Quality Control  
 Location: \_\_\_\_\_

Sampled By: D. Cripe Date: 1/26/98  
 Submitted By: D. Cripe Date: 1/26/98

Project No.: 63981003-C2 Date of Report: 2/16/98  
 Sample I.D. No. or Description: \_\_\_\_\_

Aggregate Source: Cortaro, Plant 23

Aggregate Type: #8 Concrete Aggregate

Reviewed By: J. D. Obenau 

**Sieve Analysis, ASTM C136****Test Standards are ASTM unless otherwise indicated**

Sieve Size	Passing % Accumulative	Specification	
		ASTM C33	
		#8	
		Min.	Max.
3"			
5"			
4"			
3"			
2"			
1 1/2"			
1"			
3/4"			
1/2"			100
3/8"	100	85	100
1/4"	56		
#4	14	0	30
#8	2	0	10
#10			
#16	1	0	5
#30			
#40			
#50			
#100			
#200	0.3		1.0

Test	Standard	Results	Specifi- cation
Fineness Modulus	C125		
Dry Rodded Unit Wt, pcf	C29		
Lightweight Pieces, % Conc/Lignite	C123		
Clay Lumps & Friable, %	C142	0.0	5.0 Max
Organic Impurities	C40		
Sand Equivalent Value	C2419		
LA Abrasion, % Grade	C131		
Soundness-Mg, %loss	C88		
Soundness-Na, %loss	C88	7	12 Max
Fractured Face, % by Wt.			
One or more			
Two or more			
Liquid Limit	D4318		
Plasticity Index	D4318		
LA Abrasion, 100 Rev	C131-B	7	
LA Abrasion, 500 Rev	C131-B	30	50 Max
Specific Gravity	Absorption, %	C127	1.81
	Bulk (Dry)	C127	2.520
	Bulk (SSD)	C127	2.565
	Apparent	C127	2.640

Comments:

Copies to:

**FOR APPROVAL**

APR 04 2000

**TPAC**

**Terracon**

355 S. Euclid Ave., Suite 107

Tucson, AZ 85719

(520) 770-1789

**Physical Properties of Aggregates**

Client Name: San Xavier Rock & Materials  
 Address: P.O. Box 551  
Cortaro, Arizona 85652

Project Name: Annual Quality Control  
 Location: \_\_\_\_\_

Sampled By: D. Cripe Date: 1/26/98  
 Submitted By: D. Cripe Date: 1/26/98

Project No.: 63971003-C1 Date of Report: 2/16/98  
 Sample I.D. No. or Description: \_\_\_\_\_

Aggregate Source: Cortaro, Plant 23

Aggregate Type: #57 Concrete Aggregate

Reviewed By: J. D. Obenauer 

**Sieve Analysis, ASTM C136****Test Standards are ASTM unless otherwise indicated**

Sieve Size	Passing  % Accumulative	Specification		Test	Standard	Results	Specifi- cation
		ASTM C33					
		#57					
		Min.	Max.				
6"				Fineness Modulus	C125		
5"				Dry Rodded Unit Wt, pcf	C29		
4"				Lightweight Pieces, % Conc/Lignite	C123		
3"				Clay Lumps & Friable, %	C142	0.0	5.0 Max
2"				Organic Impurities	C40		
1-1/2"			100	Sand Equivalent Value	C2419		
1"	100	95	100	LA Abrasion, % Grade	C131		
3/4"	92			Soundness-Mg, %loss	C88		
1/2"	47	25	60	Soundness-Na, %loss	C88	7	12 Max
3/8"	22			Fractured Face, % by Wt			
1/4"	4	0	10	One or more			
#4	2	0	5	Two or more			
#8	2			Liquid Limit	D4318		
#10				Plasticity Index	D4318		
#16							
#30							
#40				LA Abrasion, 100 Rev	C131-B	7	
#50				LA Abrasion, 500 Rev	C131-B	28	50 Max
#100							
#200	0.4		1.0				
				Specific Gravity	Absorption, %	C127	1.80
					Bulk (Dry)	C127	2.517
					Bulk (SSD)	C127	2.563
					Apparent	C127	2.637

Comments:

Copies to:

**FOR APPROVAL**

APR 04 2000

**TPAC**